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Measuring cosmological "Causality Distances" using VLBI.

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Abstract

Distance is one of the most important yet hard to determine measurements in astronomy. Many methods such as parallax, Type Ia supernova and Cepheid variables have turned astronomy into astrophysics. Active Galactic Nuclei (AGN) are amongst the most luminous objects in the Universe and have long been desired as a distance measurement. By analyzing radio flares in AGN jets we can use causality arguments to calibrate a standard ruler. This is then compared against the apparent sizes as measured using Very Long Baseline Interferometry (VLBI). A 'Causality Distance' can then be estimated. This approach is being adopted in the Cosmological Quasar Observations on the KVN from Korea to Australia and South Africa (QUOKKAS) project, which is currently observing 50 AGN weekly in a redshift range $0 < z < 5$. We have applied this technique to archival MOJAVE (Monitoring Of Jets in Active Galactic Nuclei with VLBA Experiments) data to determine how best to actually use the method. Here, 15 sources were selected and their angular diameter distances were determined (using the Causality Distance method) and then compared against a standard cosmological model. In this way, we estimate our statistical and systematic uncertainties and find that we could be competitive with other distance measures within 5-10 years of observations.

My poster in zenodo.org can be found here